of the vessel is about a litre or 1000 cubic centimetres. But since we know that the exhaustion has reduced the density to $\frac{1}{4000000}$ of its original, the volume occupied by the residual gas at ordinary pressures would be that of a little bubble $\frac{1}{100}$ of an inch in diameter.

Sir Wm. Thomson, T. Clerk-Maxwell, and Clausius have shown that in a gas, at ordinary pressure, the mean or average path between two collisions is about $\frac{1}{10000}$ of a millimetre. When the pressure is reduced to $\frac{1}{4000000}$ the mean will be 400 millimetres, or about a foot and a half. What takes place is this. The particles of the gas are flying about in all directions, with a velocity which depends on the temperature. When they impinge on the heated disc their velocity is increased, they go off with a greater velocity than those which go off from the colder side, and hence there is a recoil of the disc. When the gas is at all dense the particles get a very short way before they are met by another and sent back, and so the velocity gets a common velocity before any visible action takes place. When the gas is rare the particles may get a long way off before they meet others, and so the action becomes perceptible.

In case of cooling they go away with diminished velocity and a negative recoil.

The author of the paper went on to show that the total mechanical action on a square centimetre of black surface derived from the radiation of a magnesium lamp, at a distance of 150 mill., did not exceed a continuous pressure of $\frac{1}{50}$ part of a milligramme, and that the total work done did not amount to the five-millionth part of the available energy received by the movable surfaces.

*ADDITION TO OUR KNOWLEDGE OF THE TERMITES**

FRITZ MÜLLER has recently published a short but interesting memoir on the larvæ of Calotermes, a genus of Termites, which he describes with his wonted care and accuracy. We cannot, of course, here follow him in detail; but, as is so often the case in the writings of this eminent naturalist, he draws our attention by his descriptions to several points of unusual interest. As occurs in some other insects, the youngest larvæ of Calotermes differ much in form from those somewhat more advanced in age. The form of the younger larvæ may be accounted for on two hypotheses. It may be an adaptation to the mode of life, or it may be the original larval form of the group. In the latter case, Herr Müller considers that it would be an extremely interesting form, because, in his opinion, Calotermes is one of the oldest, if not the oldest, of existing insect genera; since, according to Hagen, the carboniferous Termites described by Goldenburg from the cold strata belong to this group. Under the latter hypothesis, therefore, the younger larvæ of Calotermes would have, as regards insects, an interest similar to that possessed by Nauplius among Crustacea; and, according to Müller, the latter really is the case. The youngest larvæ of Calotermes live with their elder sisters, in the same localities, on the same food, and, in fact, under precisely the same conditions. These older larvæ have, in a word, completely adapted themselves to their dwelling-place and mode of life. Like most animals which burrow in earth, wood, or stone, they are cylindrical in form. Not so the youngest larvæ, which are flattened, and have the thorax laterally expanded. Their structure is, in Müller's opinion, as unsuitable as possible for animals inhabiting wood. This form is therefore probably only possessed through inheritance from far distant ancestors.

It is unnecessary to point out how great is the interest attaching to these larvæ, if Müller's view be correct; nor would I venture to express any dissent from his conclusions. But, I confess, there seems to me a difficulty in comprehending why the younger larvæ have not adapted themselves to their conditions, in like manner as their elders.

May there not possibly be some circumstances which have hitherto escaped observation, and which might render the form of these larvæ not so altogether unsuitable as Müller supposes?

I will just refer to one other point in this interesting paper. The author shows that the main, if not the whole growth of the antenna takes place in the third segment: the two basal ones and the terminal portion remaining almost unaltered. My husband, many years ago (Linn. Trans., 1863), showed this to be the case in the Ephemera (*Chloeön*), and it would be interesting to know whether the same thing occurs among other Neuroptera.

High Elms ELLEN LUBBOCK

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* By Fritz Müller.

NOTES

THE Loan Exhibition of Scientific Apparatus at South Kensington, to which we have already referred (vol. xi. p. 301), will open on the 1st of April, 1876, and remain open until the end of September, after which time the objects will be returned to the owners. It will, as we have already intimated, consist of instruments and apparatus employed for research, and other scientific purposes, and for teaching. It will also include apparatus illustrative of the progress of science, and its application to the arts, as well as such as may possess special interest on account of the persons by whom, or the investigations in which, it had been employed. The precise limits are detailed under several sections in a syllabus which has been issued for the information of exhibitors. Models, drawings, or photographs will also be admissible where the originals cannot be sent. The apparatus may, in certain cases, be arranged in train as used for typical investigations; and arrangements will be made, as far as it may be found practicable, for systematically explaining and illustrating the use of the apparatus in the various sections. Forms on which to enter descriptions of objects offered for exhibition may be obtained on application to the Director of the South Kensington Museum, London, S.W. These forms should be filled up and returned as soon as possible, so that exhibitors may receive early intimation as to the admissibility of the objects they propose to send. The cost of carriage of all objects selected for exhibition will be defrayed by the Science and Art Department. It is hoped that institutions or individuals having instruments of historic interest will be good enough to lend them. The following are the various sections into which the Exhibition will be divided:—Arithmetic, Geometry, Measurement, Kinematics, Statics and Dynamics, Molecular Physics, Sound, Light, Heat, Magnetism, Electricity, Astronomy, Applied Mechanics—[as the Exhibition must be regarded as chiefly referring to education, research, and other scientific purposes, it must in this division consist principally of models, diagrams, mechanical drawings, and small machines, illustrative of the principles and progress of mechanical science, and of the application of mechanics to the arts],—Chemistry Meteorology, Geography, Geology and Mining, Mineralogy, Crystallography, and Biology.

MR. SULLIVAN on Tuesday, in the House of Commons, moved with regard to the necessity for having a Museum of Science and Art in Dublin. He, as well as the other speakers, seems to be ignorant of the fact that in addition to its educational staff and appliances, the Royal College of Science in Dublin possesses the germ of an admirable museum which formerly constituted the Museum of Irish Industry. It seems probable that what is needed is a removal of the specimens from the College to a suitable building; probably an enlargement of the Royal Dublin Society would be best, and the space thus gained in the College of Science would be invaluable for laboratories. Few of the outside public are aware what a fine collection of mechanical apparatus the late Professor of Mathematics, Dr. Ball, made in the College, and how highly desirable it is that these should be turned to active and good use by his successor.

THE Royal Commission on Scientific Instruction and the Advancement of Science have held their final sitting and appended their signatures to the Sixth Report on Science Teaching in Public and Endowed Schools; the Seventh Report on the Universities of London, Scotland, Dublin, and the Queen's University in Ireland; and the Eighth and Final Report on the Advancement of Science and the relations of Government to that branch of study.

FOR the Paris International Geographical Exhibition an immense number of photographs have been received from the Palestine Exploration Fund, which will afford a good idea of the work done by British explorers. The Russian and Austro-Hungarian Governments have erected, each at its own expense, an elegantly fitted pavilion on the terrace *du bord de l'Eau*, where their exhibits will find ample room. M. Esler, the Danish delegate, has brought with him a complete collection of the dresses used by the natives of Greenland. All the original maps of Paris, from the celebrated tapestry carpet up to the latest published by M. Haussmann, will be exhibited by the French Government. A special section has been arranged for alimentary preparations useful for travelling purposes, and another for inventions relating to salvage.

SESSION 1875-6 of the Teachers' Classes of St. Thomas Charterhouse School of Science will commence on Sept. 25 next. A public meeting will be held on some Saturday early in October, when an address will be delivered by Dr. Carpenter. The managers of the Gilchrist Trust have made a grant for the delivery of a course of lectures, on alternate Friday evenings, during the session. The arrangements are in the hands of Dr. Carpenter, secretary to the Trust, who is in active communication with Professors Huxley and Tyndall and other eminent lecturers. The lectures will be delivered in the Foresters' Hall, Wilderness Row, near the Charterhouse Schools.

THE Committee of the French Association for the Advancement of Science, which meets at Nantes on August 19, have issued invitations and a list of some of the French men of science expected to be present. Among the subjects which will be brought before the Association are Researches on Prussic Acid, by M. Claude Bernard; an important paper by M. Pasteur on Beer; an account of the work relating to the Meridian of France, by Commandant Perrier; and a new rhinoplastic process, by Dr. Ollier. Among those expected to be present are, MM. Dumas, Claude Bernard, Pasteur, H. St. Claire Deville, De Quatrefages, Levasseur, P. Broca, E. Caventou, L. Lefort, E. Moreau, Trélau, Verneuil, and other eminent scientific Frenchmen.

AT the half-yearly general meeting of the Scottish Meteorological Society on Tuesday last two interesting papers were read; one on "The Mortality of the Large Towns of the British Islands in relation to Weather," by Mr. Buchan; and the other on "Weather and Epidemics of Scarlet Fever in London during the past thirty-five years," by Dr. Arthur Mitchell. We hope to be able to give a notice of these papers in our next number.

ON the 7th of July an extraordinary hail and thunder storm raged over a large part of France, many towns having been deluged in succession. At Geneva, where the phenomenon was more satisfactorily observed than elsewhere, it was found that the hailstones fell on a belt at first only four kilometres in breadth, but enlarging, when near the lake, to about thrice that breadth. The path of these thunderstorms will be investigated by the Meteorological Boards of the different departments, but it will take some time before they are correctly mapped. M. Dumas, at Monday's sitting of the Paris Academy, read a letter from M. Calladon, of Geneva, stating that hailstones of 300 grammes each had been collected; and a letter from M. W. de Fonvielle, describing the icicles observed by M. Duruof on his balloon in his last ascent, about ten days ago. M. Dumas directed the attention of the Academy to the importance of that observation, in order to explain how gigantic hailstones can be generated during abnormal atmospheric perturbations.

THERE is nothing particularly noteworthy in the Report presented by the Radcliffe Observer to the Board of Trustees on June 29. The work of the Observatory has been steadily pursued, interrupted only by an unusual amount of unfavourable weather. A great advance has been made in the reduction and printing of the observations during the past year.

A LIVELY interest in science seems to have been awakened in Aberdeen, by means of lectures on anatomy and physiology, delivered gratuitously by Prof. Struthers on Saturday evenings in Marischal College. They have been very largely attended by both sexes, and particularly by that portion of the community, comprising all classes, whose opportunities for instruction in scientific subjects have been necessarily restricted. A beautifully illuminated and handsomely mounted address was recently presented to Dr. Struthers by the Dean of Guild of the city on behalf of a large number of subscribers, as a mark of their appreciation of his disinterested labours. The Aberdeen School Board had been stimulated to resolve to introduce some physical science into the Grammar School. They propose to have a course of Elementary Chemistry and Elementary Physics, and also one of Botany. The Mechanics' Institution of Aberdeen, now aided by a munificent bequest from the late Dr. Neil Arnot, himself an Aberdonian, is also doing valuable work in the way of disseminating systematic knowledge in various branches of physical science.

THE Halifax Geologists' Field Club now consists of ninety members, and during the past year many papers have been read and a considerable number of excursions made. The president, Mr. J. W. Davis, in his address on May 19, gave an interesting sketch of the work done at the Settle Caves. Mr. L. C. Miall gave a lecture on the 2nd June on the Construction of Geological Maps; and on the 16th, Prof. A. H. Green lectured on the General Structure of the Central Part of Yorkshire Coal Field. The Club seems to be in a healthy condition.

WE are glad to see from the "Reports and Proceedings" for 1874 and part of 1875 of the Miners' Association of Cornwall and Devon, which carries on its work to some extent in connection with the Science and Art Department, that notwithstanding the present great depression in mining, this exceedingly useful Association has been able to continue its good work among the class for whose benefit it has been founded. The report of the lecturer, Mr. B. Kitto, F.G.S., is very satisfactory, and is followed by a number of valuable papers on various subjects connected with mining.

THE *Revue Scientifique* for July 10 contains M. J. Bertrand's valuable account of the life and work of the late M. Elie de Beaumont, recently read before the Paris Academy of Sciences.

PRINCIPAL DAWSON has sent us an interesting paper, being the Presidential Address to the Natural History Society of Montreal for 1875, entitled "Recollections of Sir Charles Lyell," containing among other things some personal reminiscences of the great geologist's visits to America.

THE "Proceedings of the American Academy of Arts and Sciences" for 1874-5 are just to hand; the following is a list of the papers contained in the volume:—Researches on the Hexatomic Compounds of Cobalt, by Wolcott Gibbs, M.D. Contributions to the Botany of North America, by Asa Gray. Graphical Integration, by Edward C. Pickering. On the Solar Motion in Space, by Truman Henry Safford. Historical Sketch of the Generic Names proposed for Butterflies: a contribution to Systematic Nomenclature, by Samuel H. Scudder. On the wide diffusion of Vanadium and its association with Phosphorus in many Rocks, by A. A. Hayes, M.D. Foci of Lenses placed obliquely, by Prof. E. C. Pickering and Dr. Chas. H. Williams. On the Effect of Heat upon the Magnetic Susceptibility of Soft Iron, by H. Amory and F. Minot. A Conspectus of the North American Hydrophyllaceæ, by Asa Gray. Revision of the Genus Ceanothus, and Descriptions of New Plants, with a Synopsis of the Western Species of Silene, by Sereno Watson. List of the Marine Algæ of the United States, with Notes of New and Imperfectly Known Species, by W. G. Farlow. On a New Induction Coil, by John Trowbridge. On the Effect of Armatures on the Magnetic State of Electro-Magnets, by B. O. Peirce and E. B. Levafour. On the Time of Demagnetisation of Soft Iron, by W. C. Hodgkins and J. H. Jennings. Light transmitted by one or more Plates of Glass, by W. W. Jacques. On the Application of Logical Analysis to Multiple Algebra, by C. S. Peirce. On the Uses and Transformations of Linear Algebra, by Benjamin Peirce. On a New Optical Constant, and on a Method of Measuring Refractive Indices without the use of Divided Instruments, by Wolcott Gibbs, M.D. Intensity of Twilight, by Charles H. Williams. Light of the Sky, by W. O. Crosby. Light absorbed by the Atmosphere of the Sun, by E. C. Pickering and D. P. Strange. Tests of a Magneto-electric Machine, by E. C. Pickering and D. P. Strange. Answer to M. Jamin's Objections to Ampère's Theory, by William W. Jacques. Melanosiderite: a New Mineral Species, from Mineral Hill, Delaware County, Pennsylvania, by Josiah P. Cooke, jun. On Two New Varieties of Vermiculites, with a Revision of the other Members of this Group, by Josiah P. Cooke, jun., and F. A. Gooch.

AT a meeting of the Council of the Royal School of Mines, held on Saturday, July 3rd, the following gentlemen received the diploma of Associate of the Royal School of Mines:—Mining and Metallurgical Divisions: Harry H. Becher, W. Frecheville, F. H. Marshall, Ambrose R. Willis. Mining Division: Archibald E. Pinching, G. Seymour, H. Lamont Young. Metallurgical Division: G. Fitz Brown, Robert Hellon, W. Foulkes Lowe, Thomas Purdie. Geological Diivsion: G. C. Frames. The following scholarships and prizes were also awarded:—Third-year Students: The De la Beche Medal and prize of books to Mr. G. Fitz Brown; the Murchison Medal and prize of books for Geology to Mr. G. Seymour. Second-year Students: H.R.H. the Duke of Cornwall's Scholarship of 30*l.* for two years to Mr. H. Louis, and the Royal Exhibition of 25*l.* to Mr. W. Hewitt. First-year Students: Two Royal Scholarships of 15*l.* each to Mr. A. N. Pearson and Mr. L. J. Whalley.

DURING the past week the Commission on Vivisection have held several meetings. The absence of Prof. Huxley is to be regretted.

IN the secret committee which was held after Monday's sitting of the Paris Academy of Sciences the claims of M. Mouchez and M. Wolf to the vacant membership in the section of Astronomy were warmly discussed. The election will probably take place next Monday. M. Mouchez is one of the most successful of the Transit observers, and M. Wolf is the sub-director of the Paris Observatory.

A SECOND specimen of a Two-horned Asiatic Rhinoceros was yesterday deposited in the Zoological Society's Gardens. It closely resembles the Hairy-eared species, and does not differ much from the Sumatran animal.

A SECOND edition has been issued of "The Unseen Universe; or, Physical Speculations on a Future State" (Macmillan and Co.)

THE Geologists' Association will make a five days' excursion into East Yorkshire, commencing on July 19.

IN connection with the calamitous floods around Toulouse, on the 25th June a singular phenomenon was observed at Clermont-sur-Lanquet. The whole of the earth on the slope of a mountain was moved bodily, a shepherd's house being transported uninjured to a distance.

WE have received a paper addressed to the Royal Society of Edinburgh by M. F. Lefort, Inspecteur-Général des Ponts et Chaussées, containing Observations relative to Mr. Edward Sang's "Remarks on the Great Logarithmic and Trigonometrical Tables calculated in the Bureau du Cadastre under the direction of Prony." Appended to the paper is Mr. Sang's reply to M. Lefort's observations.

WE have received the "Astronomical and Meteorological Observations" made during the year 1872 at the U.S. Naval Observatory.

TO those who are interested in the question of the pollution of rivers, we would commend a letter to the Right Hon. G. Sclater-Booth, President of the Local Government Board, entitled "The Pollution of Rivers, by a Polluter" (Mr. E. C. Potter, of Manchester). In a very moderate and reasonable way it advances some arguments in favour of the polluter's side of the question.

THE Thirteenth Annual Report of the Birmingham Free Libraries Committee for 1874 is on the whole a satisfactory one. The aggregate number of issues for the year is 542,887, and although this is only an increase of about 3,000 over 1873, there is a very marked increase in the issues of books to readers in the Reference Library, indicating the growing use of a higher class of works than are deposited in the Lending Library, and showing that the Free Library system is bearing fruit in raising the standard of taste and cultivation among readers. The issue of scientific works both in the Lending and Reference Libraries bears a very fair proportion to that in other departments.

WE have received a paper by Mr. W. W. Wagstaffe, of St. Thomas's Hospital, on the mechanical structure of the cancellous tissue of bone, in which the arrangement of the trabeculæ of the articular ends of the human bones are described, from sections, on the same principle as that previously adopted by Mr. F. Ward, Julius Wolff, and others.

THE additions to the Zoological Society's Gardens during the past week include a Maholi Galago (*Galago maholi*) from S. Africa, presented by Mr. C. E. Thomson; two Angulated Tortoises (*Chersina angulata*) from S. Africa, presented by Mr. L. A. Knight; a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, presented by Mr. Alfred Thompson; seven Garganey Teal (*Querquedula circia*), and a Temminck's Tragopan (*Ceriornis temmincki*) from China; two Argus Pheasants (*Argus giganteus*) from Malacca, deposited; two Giant Tortoises (*Testudo indica*) from the Aldabra Islands, purchased; a Malbrouck Monkey (*Cercopithecus cynosurus*) from W. Africa, received in exchange; a Hog Deer (*Cervus porcinus*) and five Chiloe Wigeons (*Mareca chiloensis*) born in the Gardens.